
BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 279 8/10 to 295 9/10

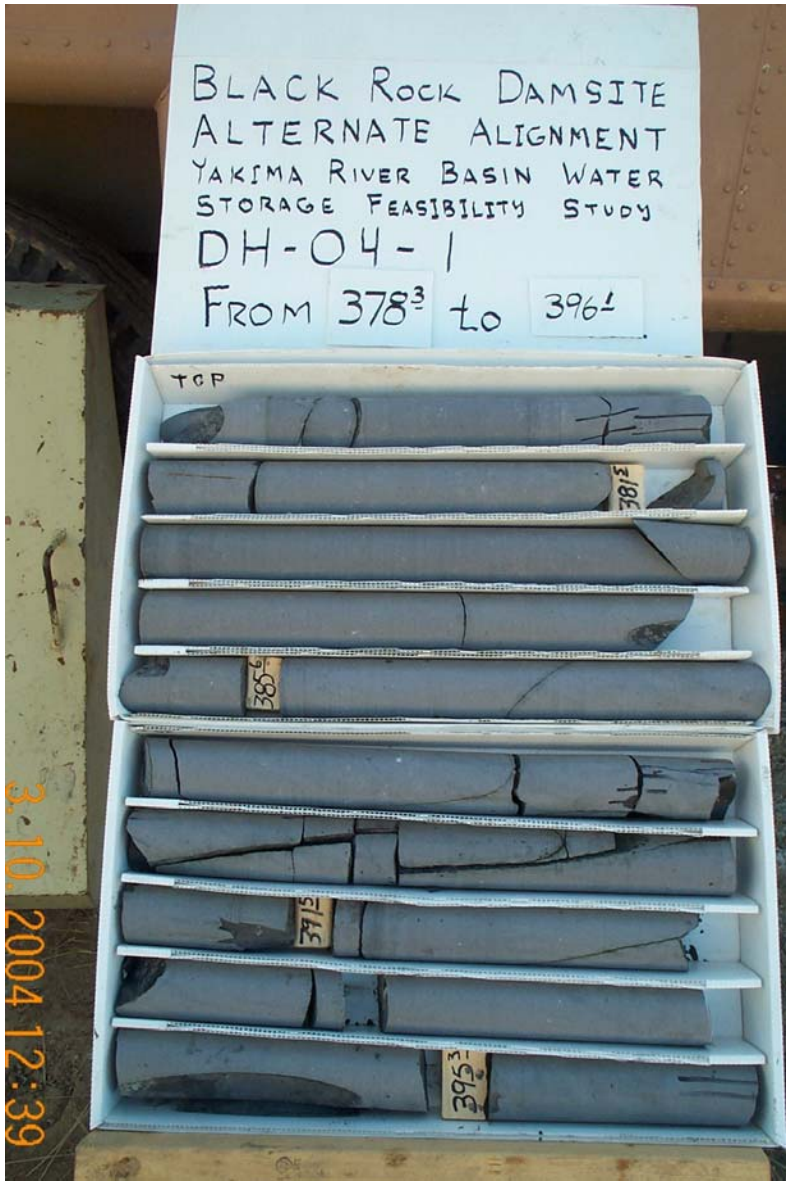

BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 295 9/10 to 310 3/10

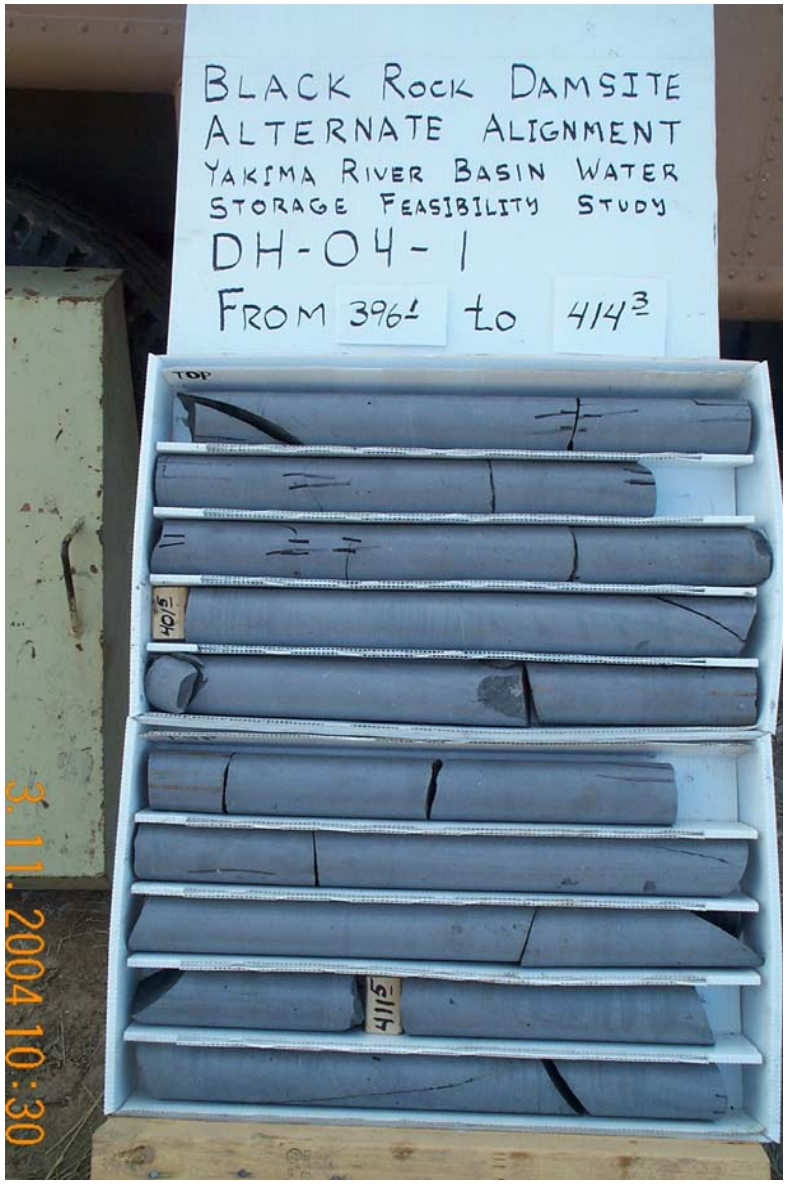

BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 310³ to 326⁷
310³
326⁷


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 326⁷ to 349⁹
330⁴
335⁹
340³
349⁹


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 349 9/10 to 360 8/10
TOP
3582
360
3.9.2004 14:53


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 360 8/10 to 378 3/10
TOP
3715
3615
3.10.2004 09:36


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 378 3 TO 396 1
TOP
3.10.2004 12:39


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 396 1 TO 414 3
TOP
3.11.2004 10:30


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 414.3 to 432.8
TOP
3.12.2004 09:48


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 432.8 to 450.4
TOP
3.12.2004 10:18


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 450' to 477'

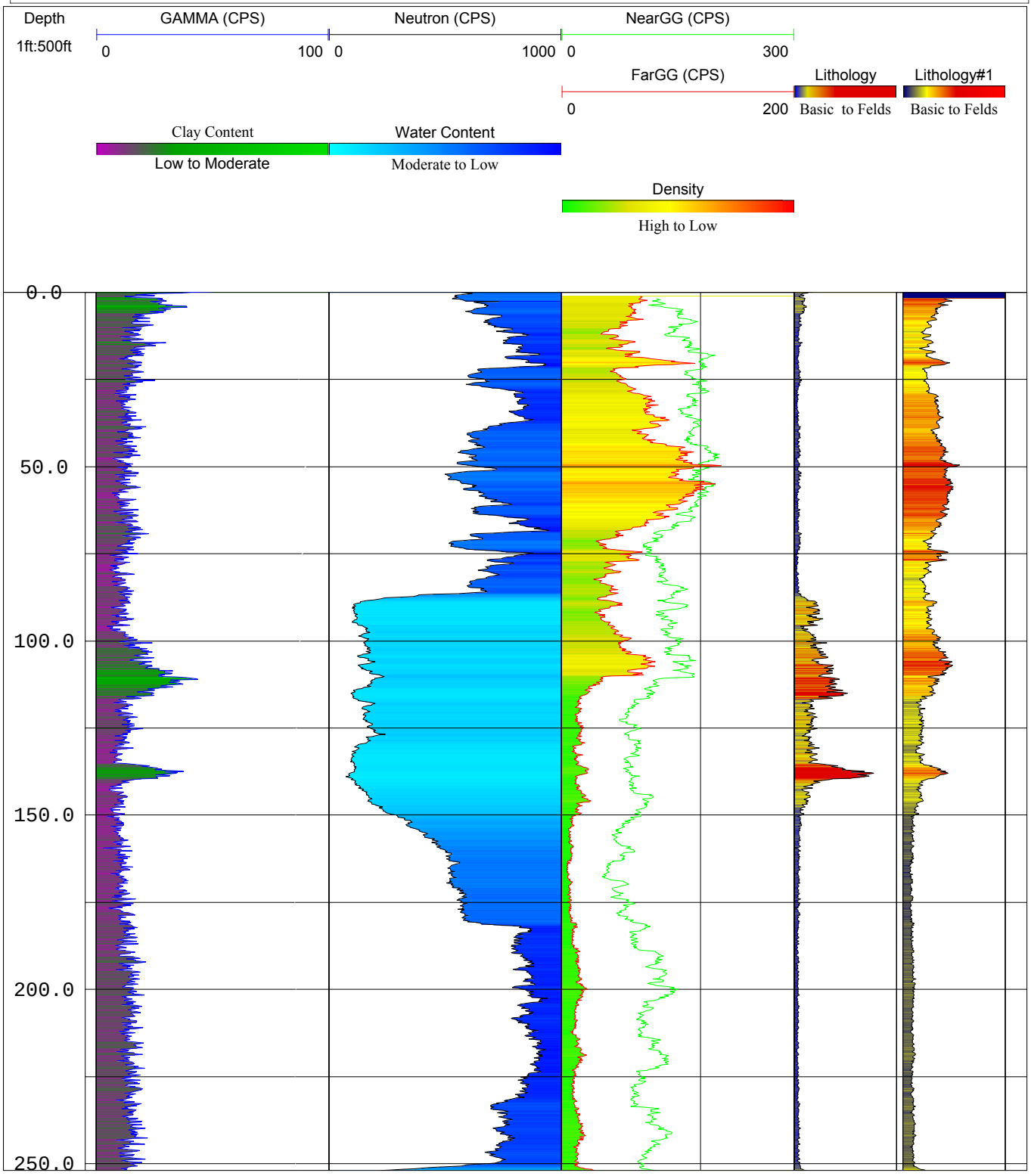

BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 477' to 508'
TOP

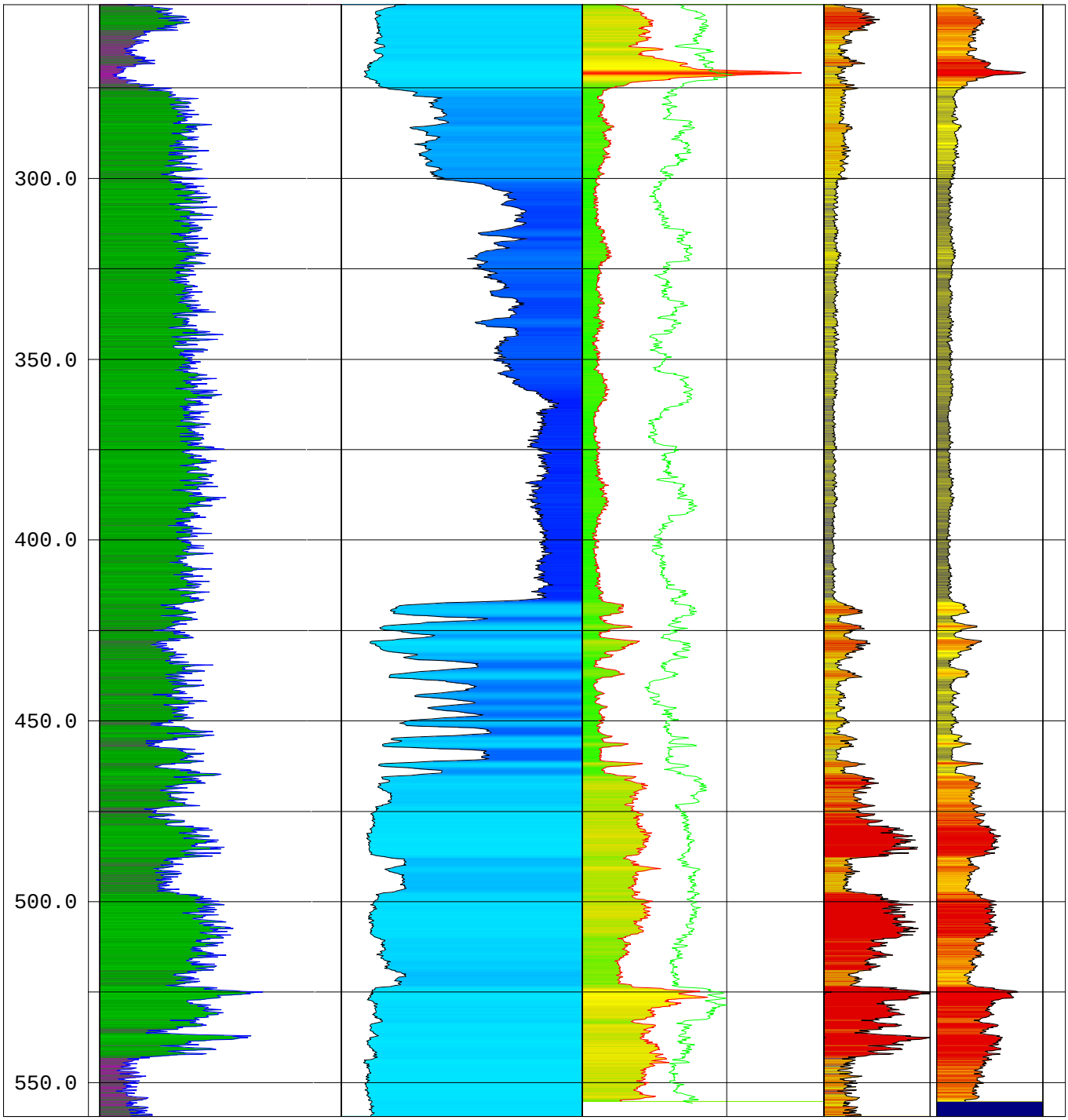

BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 508' to 536'
TOP
TOP


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 536' to 562.3
TOP
TOP

BUREAU OF RECLAMATION

PROJECT Black Rock HOLE NO. DH04-01




300.0
350.0
400.0
450.0
500.0
550.0

GEOLOGIC LOG OF DRILL HOLE NO. DH-04-2

FEATURE: Black Rock Alternate Damsite
LOCATION: North of Washington State Highway 24
BEGUN: 4/1/04 FINISHED: 6/3/04
DEPTH AND ELEV OF WATER
LEVEL AND DATE MEASURED: 194.1 (1156.46) 6/03/04

PROJECT: Yakima River Basin Water Storage Project
COORDINATES: N 439,391.5 E 1,790,479.2
TOTAL DEPTH: 530.0
DEPTH TO BEDROCK: 144.0

STATE: Washington
GROUND ELEVATION: 1350.6
ANGLE FROM HORIZONTAL: AZIMUTH:
HOLE LOGGED BY: Didricksen/McAffee
REVIEWED BY: R. Link

NOTES	DEPTH	% RECOVERY	SPT	ENGINEERING PROPERTIES: WEATHERING	HARDNESS	FRACTURE DENSITY	RQD	FIELD CLASSIFICATION	LAB CLASSIFICATION	GEOLOGIC UNIT	GRAPHIC	HOLE COMPLETION	CLASSIFICATION AND PHYSICAL CONDITION
All elevations measured from ground surface and are same as driller reported. PURPOSE OF HOLE: Hydro-geologic testing DRILL SETUP: Setup on original ground surface approximately 260 feet north of Washington State Highway 24. DRILLING EQUIPMENT: Ingersoll-Rand T-2 Truck mounted drill. DRILLER: Chris Peterson DRILLING METHODS: **0.0-149.0'** Advanced hole with 7-7/8" rock bit and 8" casing using air as circulating fluid to remove the cuttings from 0-87.0' and 97.0-129.0'. Air and water with foam was used to remove cuttings from 87.0-97.0' and 129.0-149.0'. Constant Head tests were conducted at the intervals of 27.0-31.0', 77.0-81.7' and 117.0-137.0'. **149.0-230.0'** Advanced hole with 5-7/8" downhole hammer to 230.0', using air and water with foam to remove the cuttings from 149.0-230'. Constant Head tests were conducted from 148.0-168.0' and 148.0-230.0'. **230.0-314.0'** Advanced hole with 5-7/8" downhole hammer using air and water with foam to remove the cuttings to 290.0'. Bottom of packer was set at 235.7', and a Slug test was conducted from 236.0-290.0'. Packer removal was difficult due to slight caving from 190.0-200.0'. Hole was cleaned out from 148.0-200.0' with 7-7/8" downhole hammer and stabilizers. Stabilizers came apart at 200.0'. After retrieving stabilizers and downhole hammer, the hole was cleaned out	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95									Qe Qh Tr			Refer to the log of companion hole DH-04-1 for detailed descriptions of the materials present at this site. All descriptions of material in this log are based on drilling conditions and cuttings returned. 0.0-7.0': **QUATERNARY LOESS DEPOSITS (Qe).** Surficial deposits of silt with lesser amounts of clay, composed primarily of wind-blown silt with small amounts of fine sand and volcanic ash. 0.0-7.0': SILT AND SAND. 7.0-28.0': **QUATERNARY ALLUVIUM DEPOSITS (Qh).** Undifferentiated medium to coarse-grained sand with fines, gravels, cobbles and boulders composed primarily of basaltic detritus from local sources. 7.0-28.0': SILT, SAND, AND GRAVEL. 28.0-87.0': **TERTIARY RINGOLD FORMATION (Tr).** Composed of fluvio lacustrine sand, silt and clay, with cobbles and gravels in a matrix of coarse to fine sand and fines near the middle and base of the unit. 28.0-40.0': SILT, SAND, AND GRAVEL. 40.0-70.0': SILT SAND AND CLAY. 70.0-82.0': SILT, SAND, AND GRAVEL. 82.0-87.0': SILT, SAND, GRAVEL, AND COBBLES. 87.0-144.0': **TERTIARY RATTLESNAKE RIDGE MEMBER (Trr) AND INVASIVE FLOW TOP (PEPERITE) CONSISTING OF SELAH INTERBED (Ts) UNDIFFERENTIATED MEMBERS** of the Miocene Ellensburg Formation. The upper section is comprised of unconsolidated gravel and sand with silt and clay, and the lower section is comprised of pumicite material rafted to the top of the Pomona Basalt, composed of tuffaceous clay, silt, sand and gravel. 87.0-97.0': SILT AND CLAY. 97.0-119.0': SILT AND SAND. 119.0-129.0': CLAY. 129.0-132.0': CLAY, SAND, AND GRAVELS. 132.0-137.0': CLAY, SAND, AND GRAVELS. 137.0-144.0': SAND, GRAVELS AND COBBLES. 144.0-249.0': **POMONA MEMBER (Tp)** of the Saddle Mountains Basalt Formation, Miocene Columbia River Basalt Group (CRBG). Black to gray, hard, mostly fine grained, dense basalt with plagioclase phenocrysts comprising less than 5% of the rock. 144.0-249.0': BASALT.

COMMENTS: Samples were logged in the field using Designation USBR 5005-86, "Procedures for Determining Unified Soil Classification (Visual Method)."

Center column descriptors are defined in the Reclamation Engineering Geology Field Manual, Volume 1, Second Edition, distributed February 1999..

Cs = Casing Sz = Size of Casing I.D. = Inside Diameter O.D. = Outside diameter

Geologic unit descriptions and stratigraphy based partially on consulting discussions with Dr. Bentley and geologic interpretations presented in the following reports:

"Black Rock Reservoir Study, Initial Geotechnical Investigation, Prepared for Benton County Sustainable Development by Washington Infrastructures Services, Inc., Dated January 2003.

"Geologic Investigation Black Rock Dam, Alternate Dam Site, Yakima County, Washington, Prepared for U.S. Bureau of Reclamation by Columbia Geotechnical Associates, Inc., Dated February 12, 2004."

GEOLOGIC LOG OF DRILL HOLE NO. DH-04-2

FEATURE: Black Rock Alternate Damsite
PROJECT: Yakima River Basin Water Storage Project
STATE: Washington
LOCATION: North of Washington State Highway 24
COORDINATES: N 439,391.5 E 1,790,479.2
GROUND ELEVATION: 1350.6
BEGUN: 4/1/04 FINISHED: 6/3/04
TOTAL DEPTH: 530.0
ANGLE FROM HORIZONTAL: AZIMUTH:
DEPTH AND ELEV OF WATER
DEPTH TO BEDROCK: 144.0
HOLE LOGGED BY: Didricksen/McAffee
LEVEL AND DATE MEASURED: 194.1 (1156.46) 6/03/04
REVIEWED BY: R. Link

NOTES	DEPTH	% RECOVERY	SPT	ENGINEERING PROPERTIES: WEATHERING	HARDNESS	FRACTURE DENSITY	RQD	FIELD CLASSIFICATION	LAB CLASSIFICATION	GEOLOGIC UNIT	GRAPHIC	HOLE COMPLETION	CLASSIFICATION AND PHYSICAL CONDITION
with 7-7/8 downhole hammer to 215.0', and 5-7/8" downhole hammer 314.0', using air and water with foam to remove the cuttings. Pump and packer were set at 235.7', and a constant rate pump test was conducted from 236.0-273.0'. Following the test, the hole had caved from 270.0-285.0'. Hole was cleaned out with 7-7/8" downhole hammer using air and water with foam to remove cuttings. Cut slots in 6" casing with plasma cutter and began installing in hole, but could not get it to bottom due to caving. Casing was removed and hole was cleaned with a 7-7/8" tri-cone rockbit to 291.6'. 6" casing was cleaned out with a 5-7/8" rockbit and advanced with a casing hammer to 314.0'. Slotted section is 254.0-294.0'. Pump was set at 245.0', and a step test, pump/constant rate, and slug tests were conducted from 254.0-294.0'. **314.0-405.0'**: Advanced hole with 5-7/8" downhole hammer using air to remove to cuttings to 405.0'. Top of packer was set at depths 362.0' and 372.0', but would not seal. Packer sealed with the top at 352.0', and slug test were conducted at 356.0-405.0' and 381.0-405.0'. **405.0-530.0'**: Advanced hole with 5-7/8" downhole hammer using air to remove cuttings. Encountered heaving sand at 515.0-520.0'. Installed 3" PVC screen and riser to stabalize hole before conducting hydro tests. 8" casing broke while extracting, left in hole from 103.0-143.0'. An airlift/constant drawdown test was conducted in the Mabton unit, and pneumatic slug test were conducted in DH-04-2 and DH-04-1. DRILLING CONDITIONS: **0.0-7.0'**: Fast and smooth. **7.0-70.0'**: Slow to fast and moderately rough. **70.0-87.0'**: Slow and rough. **87.0-129.0'**: Moderately fast and smooth. **129.0-168.0'**: Moderately slow and rough. **168.0-245.0'**: slow and rough to smooth. Caving was noted at depths of	105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210 215									Trr/Ts Tp			249.0-280.0': **SELAH INTERBED (Ts)** of the Miocene Ellensburg Formation. 249.0-280.0': SAND AND GRAVELS. 280.0-466.0': **ESQUATZEL/UMATILLA UNDIFFERENTIATED MEMBERS (Teq/Tum)** of the Saddle Mountains Basalt Formation, Miocene Columbia River Basalt Group (CRBG). Black to gray, hard, mostly fine grained dense basalt. 280.0-466.0': BASALT. 466.0-530.0': **MABTON INTERBED (Tm)** of the Miocene Ellensburg Formation. Light green to to dark brown, tuffaceous siltstone and sandstone. 466.0-515.0': SANDSTONE AND SILT STONE. 515.0-520.0': SAND. 520.0-530.0': SAND AND CLAY.

GEOLOGIC LOG OF DRILL HOLE NO. DH-04-2

FEATURE: Black Rock Alternate Damsite
LOCATION: North of Washington State Highway 24
BEGUN: 4/1/04 FINISHED: 6/3/04
DEPTH AND ELEV OF WATER
LEVEL AND DATE MEASURED: 194.1 (1156.46) 6/03/04

PROJECT: Yakima River Basin Water Storage Project
COORDINATES: N 439,391.5 E 1,790,479.2
TOTAL DEPTH: 530.0
DEPTH TO BEDROCK: 144.0

STATE: Washington
GROUND ELEVATION: 1350.6
ANGLE FROM HORIZONTAL: AZIMUTH:
HOLE LOGGED BY: Didricksen/McAffee
REVIEWED BY: R. Link

NOTES

176.0', 190.0'- 200.0', and 240.0'
245.0-249.0': Slow and rough, blocking.
249.0-285.0': Moderately slow and rough. Caving was noted at depths of 270.0'-285.0'
285.0-466.0': Slow and moderately rough.
466.0-515.0': Moderately fast and smooth.
515.0-530.0': Fast and smooth.

CASING RECORD:

Date	Sz	Hole	Cs Depth
4/1	8"	7.0'	7.0'
4/2	8"	31.0'	27.0'
4/3	8"	82.0'	77.0'
4/5	8"	97.0'	97.0'
4/6	8"	137.0'	227.0'
4/7	8"	165.0'	148.0'
4/8	8"	200.0'	148.0'
4/9	8"	230.0'	148.0'
4/10	8"	290.0'	148.0'
4/23	8"	314.0'	148.0'
5/11	6"	314.0'	314.0'
5/17	6"	374.0'	314.0'
5/18	6"	405.0'	314.0'
5/20	6"	434.0'	314.0'
5/21	6"	530.0'	314.0'

FLUID COLOR:
0.0-31.0': Brown
31.0-40.0': Tan
40.0-82.0': Reddish brown
82.0-119.0': Brown
119.0-129.0': Gray
129.0-137.0': Brown
137.0-144.0': Gray
144.0-249.0': Black
249.0-290.0': Brown
290.0-314.0': Gray
314.0-374.0': Gray
374.0-405.0': Not reported
405.0-466.0': Gray
466.0-515.0': Light brown
151.0-520.0': White
520.0-530.0': Green

FLUID RETURN:
N/A

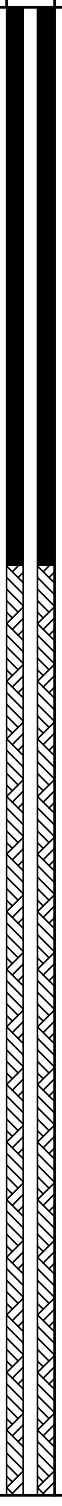
WATER LEVEL DURING DRILLING:
(from ground surface at start of shift)

Date	FL Level	Hole Dpth
04/02	Dry	7.0'
04/05	Dry	82.0'
04/07	Dry	117.0'
04/08	161.3'*	148.0'
04/09	196.4'*	200.0'
04/10	177.4'*	230.4'
04/12	206.5'	290.0'
04/13	206.5'	290.0'
04/14	206.5'	290.0'
04/20	205.6'	290.0'
04/21	205.6'	290.0'
04/23	205.6'	290.0'
04/24	202.0'	314.0'
04/27	197.4'	314.0'

DEPTH | % RECOVERY | SPT | ENGINEERING PROPERTIES: WEATHERING, HARDNESS, FRACTURE DENSITY, RQD | FIELD CLASSIFICATION | LAB CLASSIFICATION | GEOLOGIC UNIT | GRAPHIC | HOLE COMPLETION | CLASSIFICATION AND PHYSICAL CONDITION

220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 295 300 305 310 315 320 325 330 335

Ts



USBR_PN_7 BLACKRKHYDRO.GPJ USBR_PN.GDT 12/13/04 8:40:19 AM

GEOLOGIC LOG OF DRILL HOLE NO. DH-04-2

FEATURE: Black Rock Alternate Damsite
LOCATION: North of Washington State Highway 24
BEGUN: 4/1/04 FINISHED: 6/3/04
DEPTH AND ELEV OF WATER
LEVEL AND DATE MEASURED: 194.1 (1156.46) 6/03/04

PROJECT: Yakima River Basin Water Storage Project
COORDINATES: N 439,391.5 E 1,790,479.2
TOTAL DEPTH: 530.0
DEPTH TO BEDROCK: 144.0

STATE: Washington
GROUND ELEVATION: 1350.6
ANGLE FROM HORIZONTAL: AZIMUTH:
HOLE LOGGED BY: Didricksen/McAffee
REVIEWED BY: R. Link

NOTES	DEPTH	% RECOVERY	SPT	ENGINEERING PROPERTIES: WEATHERING	HARDNESS	FRACTURE DENSITY	RQD	FIELD CLASSIFICATION	LAB CLASSIFICATION	GEOLOGIC UNIT	GRAPHIC	HOLE COMPLETION	CLASSIFICATION AND PHYSICAL CONDITION
04/28 199.7' 314.0' 04/29 200.5' 314.0' 05/05 195.8' 314.0' 05/11 196.0' 314.0' 05/12 196.0' 314.0' 05/13 196.0' 314.0' 05/17 196.0' 314.0' 05/18 194.7' 374.0' 05/19 194.7' 405.0' 05/20 193.3' 405.0' 05/21 193.3' 434.0' 05/22 195.3' 530.0' 06/02 191.8'(?) 526.7' 06/03 194.1' 526.7' * Water level may be influenced from water added by drillers to clean out the hole at the end of shift the previous day. First water was noted at 254.0, producing about 10 GPM. WATER LEVEL AFTER DRILLING: 06/09 197.4' DRILLING TIME: Drilling: 320 hours. hydrotesting: 130 hours Travel/moving: 30 hrs HOLE COMPLETION: The hole was completed with 3-inch PVC and a transducer as follows: 526.7-453.0': Sand pack with slotted (0.020" slot) schedule 40 PVC (3.068" ID) with cap at 526.7-476.7'. 453.0-433.0': Cal-seal cement. 433.0-264.0': Cement. 264.0-46.0': Bentonite chips, with 8-inch casing left from 143.0-103.0'. 46.0-0.0': Cement. Installed standpipe wellhead with about 3.1' stickup. Top of riser at elevation 1353.66'. Aquistar PT2X pressure trasnducer, 30 psi range installed for long-term monitoring.	340 345 350 355 360 365 370 375 380 385 390 395 400 405 410 415 420 425 430 435 440 445 450 455									Teq/Tum			

GEOLOGIC LOG OF DRILL HOLE NO. DH-04-2

FEATURE: Black Rock Alternate Damsite
LOCATION: North of Washington State Highway 24
BEGUN: 4/1/04 FINISHED: 6/3/04
DEPTH AND ELEV OF WATER
LEVEL AND DATE MEASURED: 194.1 (1156.46) 6/03/04

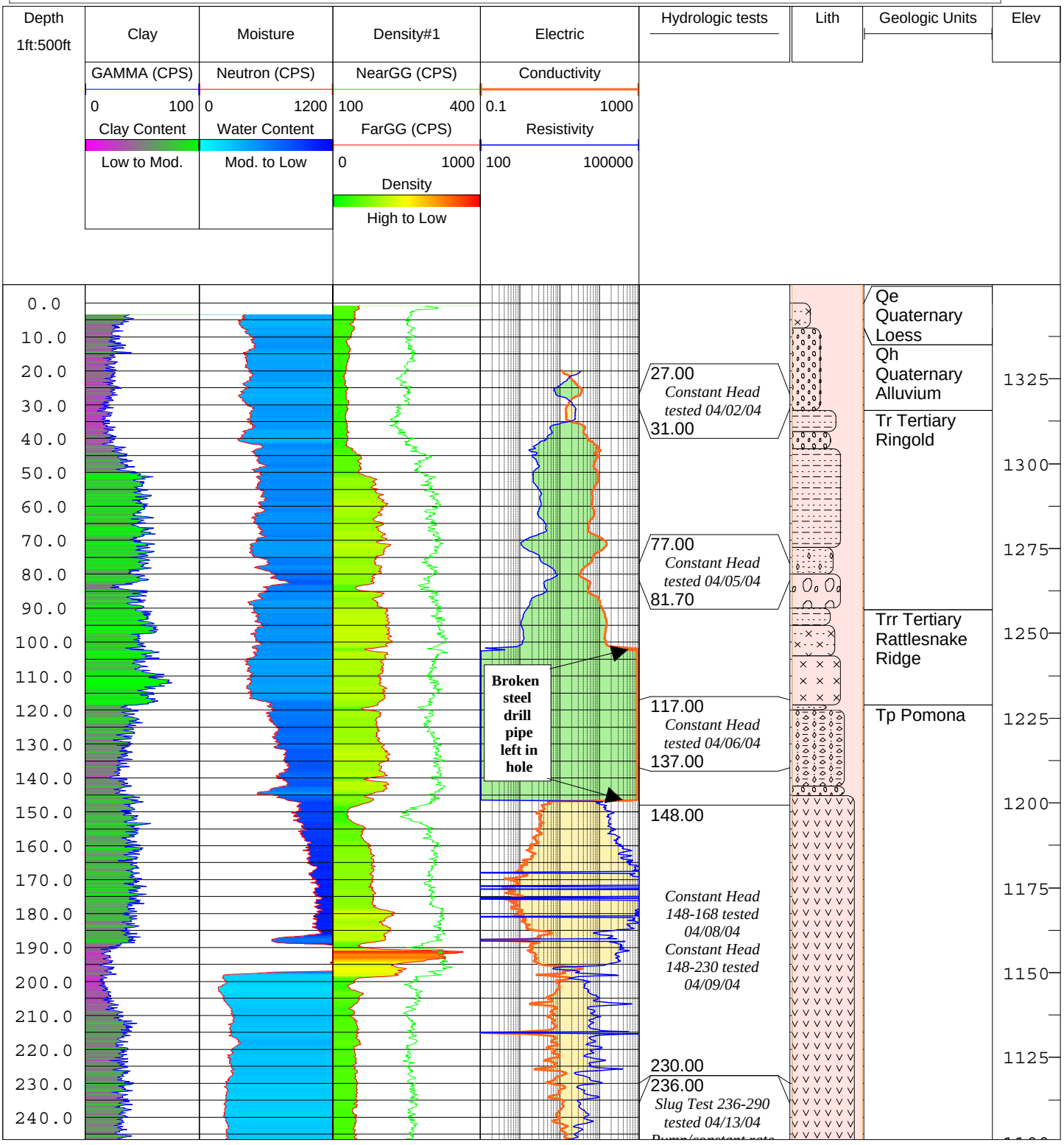
PROJECT: Yakima River Basin Water Storage Project
COORDINATES: N 439,391.5 E 1,790,479.2
TOTAL DEPTH: 530.0
DEPTH TO BEDROCK: 144.0

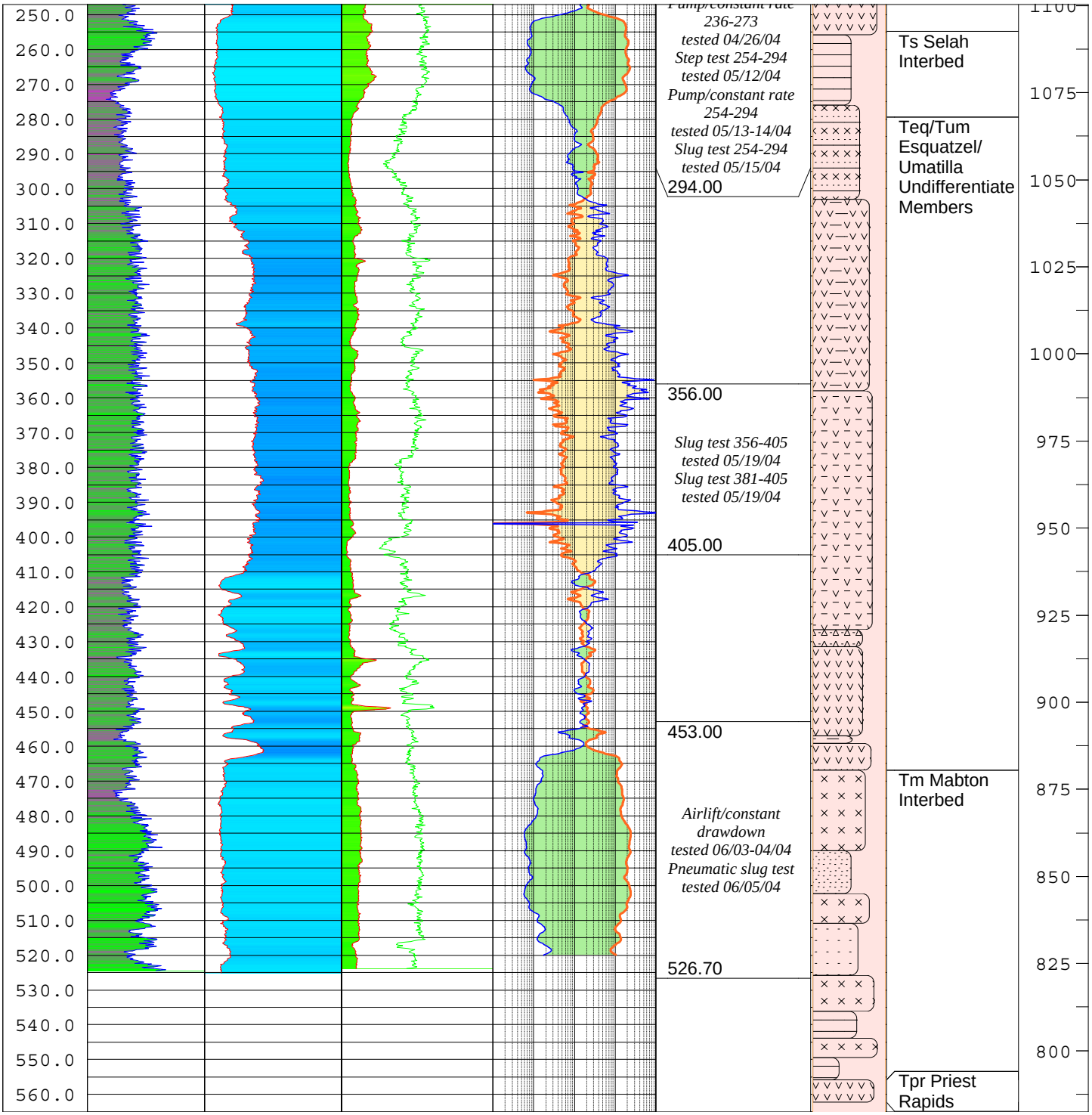
STATE: Washington
GROUND ELEVATION: 1350.6
ANGLE FROM HORIZONTAL: AZIMUTH:
HOLE LOGGED BY: Didricksen/McAffee
REVIEWED BY: R. Link

NOTES	DEPTH	% RECOVERY	SPT	ENGINEERING PROPERTIES: WEATHERING	HARDNESS	FRACTURE DENSITY	RQD	FIELD CLASSIFICATION	LAB CLASSIFICATION	GEOLOGIC UNIT	GRAPHIC	HOLE COMPLETION	CLASSIFICATION AND PHYSICAL CONDITION
	460												
	465												
	470												
	475												
	480												
	485												
	490												
	495									Tm			
	500												
	505												
	510												
	515												
	520												
	525												
	530												
	BOTTOM OF HOLE												

BUREAU OF RECLAMATION

PROJECT Black Rock HOLE NO. DH-04-02




Pump/constant rate
236-273
tested 04/26/04
Step test 254-294
tested 05/12/04
Pump/constant rate
254-294
tested 05/13-14/04
Slug test 254-294
tested 05/15/04
294.00
356.00
Slug test 356-405
tested 05/19/04
Slug test 381-405
tested 05/19/04
405.00
453.00
Airlift/constant
drawdown
tested 06/03-04/04
Pneumatic slug test
tested 06/05/04
526.70
Ts Selah
Interbed
Teq/Tum
Esquatzel/
Umatilla
Undifferentiate
Members
Tm Mabton
Interbed
Tpr Priest
Rapids
250.0
260.0
270.0
280.0
290.0
300.0
310.0
320.0
330.0
340.0
350.0
360.0
370.0
380.0
390.0
400.0
410.0
420.0
430.0
440.0
450.0
460.0
470.0
480.0
490.0
500.0
510.0
520.0
530.0
540.0
550.0
560.0
1100
1075
1050
1025
1000
975
950
925
900
875
850
825
800

Results of Geochemical Analyses

SUMMARY OF SAMPLES FOR GEOCHEMICAL TESTING – BLACK ROCK ALTERNATE DAM SITE, WASHINGTON

Sample No.	Drill Hole Designation	Location (T,R,S)	Depth (ft.)	Sample Type	*Geologic Unit
BRA-1	**DH-04-1**	**T12N, R23E, Sec 11**	**115.0**	**Ash**	**-**
BRA-2	**DH-04-1**	**T12N, R23E, Sec 11**	**221.8 – 222.0**	**Rock Core**	**Pomona**
BRA-3	**DH-04-1**	**T12N, R23E, Sec 11**	**250.2-250.4**	**Rock Core**	**Pomona**
BRA-4	**DH-04-1**	**T12N, R23E, Sec 11**	**283.1-283.3**	**Rock Core**	**Umatilla (Low MgO)**
BRA-5	**DH-04-1**	**T12N, R23E, Sec 11**	**303.2-303.4**	**Rock Core**	**Umatilla**
BRA-6	**DH-04-1**	**T12N, R23E, Sec 11**	**318.9-319.0**	**Rock Core**	**Umatilla**
BRA-7	**DH-04-1**	**T12N, R23E, Sec 11**	**360.5-360.8**	**Rock Core**	**Umatilla**
BRA-8	**DH-04-1**	**T12N, R23E, Sec 11**	**393.3-393.4**	**Rock Core**	**Umatilla**
BRA-9	**DH-04-1**	**T12N, R23E, Sec 11**	**417.5-417.8**	**Rock Core**	**Umatilla**
BRA-10	**DH-04-1**	**T12N, R23E, Sec 11**	**437.0-437.2**	**Rock Core**	**Umatilla**
BRA-11	**DH-04-1**	**T12N, R23E, Sec 11**	**456.0-456.2**	**Rock Core**	**Umatilla (Higher MgO)**
BRA-12	**DH-04-1**	**T12N, R23E, Sec 11**	**560.0-560.3**	**Rock Core**	**Priest Rapids**
BRA-13	**DH-04-1**	**T12N, R23E, Sec 11**	**561.2-561.4**	**Rock Core**	**Tpr**
BRA-14	**DH-03-2**	**T12N, R23E, Sec 14**	**66.0**	**Rock Core**	**Pomona**
BRA-15	**DH-03-3**	**T12N, R23E, Sec 11**	**97.5**	**Rock Core**	**Elephant Mnt (?)**
BRA-16	**DH-03-5**	**T12N, R23E, Sec 14**	**98.0**	**Rock Core**	**Pomona**

*Geologic unit based on sample identification using geochemical data. Identifications were determined by Dr. Robert Bentley (Columbia Geotechnical Associates, Inc.) and informally submitted to Reclamation.

GEOCHEMICAL TEST RESULTS ON SAMPLES FROM DRILL HOLES AT THE BLACK ROCK ALTERNATE DAMSITE

AUGUST 2004

	LIN BRA-2	LIN BRA-3	LIN BRA-4	LIN BRA-5	LIN BRA-6	LIN BRA-7	LIN BRA-8	LIN BRA-9	LIN BRA-10	LIN BRA-11
Date	8-Jul-04	8-Jul-04	8-Jul-04	8-Jul-04	8-Jul-04	8-Jul-04	8-Jul-04	8-Jul-04	9-Jul-04	9-Jul-04
Unnormalized Major Elements (Weight %):										
SiO2	51.93	51.68	54.41	53.70	53.89	53.48	53.36	53.01	52.97	53.17
TiO2	1.655	1.697	2.727	2.737	2.708	2.747	2.807	2.980	2.993	2.986
Al2O3	14.98	14.91	13.82	13.63	13.54	13.43	13.43	13.43	13.49	13.50
FeO*	10.47	10.17	10.33	11.37	11.50	12.11	12.18	12.23	12.51	12.38
MnO	0.175	0.172	0.153	0.186	0.207	0.211	0.211	0.209	0.208	0.213
MgO	6.39	6.78	2.08	2.48	2.63	2.96	3.01	3.20	3.03	3.15
CaO	10.92	10.87	6.55	6.51	6.44	6.39	6.46	6.67	6.75	6.74
Na2O	2.32	2.46	3.00	2.89	3.30	3.11	3.05	2.99	3.14	3.15
K2O	0.73	0.61	3.00	2.96	2.73	2.93	2.94	2.81	2.66	2.65
P2O5	0.229	0.232	0.990	0.963	0.957	0.925	0.898	0.834	0.870	0.856
Total	99.80	99.59	97.07	97.42	97.90	98.29	98.34	98.36	98.64	98.79
Normalized Major Elements (Weight %):										
SiO2	52.04	51.89	56.06	55.12	55.04	54.42	54.26	53.89	53.71	53.82
TiO2	1.658	1.704	2.809	2.810	2.766	2.795	2.854	3.030	3.034	3.022
Al2O3	15.01	14.98	14.24	13.99	13.83	13.66	13.65	13.66	13.67	13.67
FeO*	10.50	10.21	10.65	11.67	11.74	12.32	12.39	12.43	12.69	12.53
MnO	0.175	0.172	0.157	0.191	0.211	0.214	0.214	0.212	0.211	0.216
MgO	6.41	6.81	2.14	2.55	2.69	3.01	3.06	3.25	3.08	3.18
CaO	10.94	10.91	6.74	6.68	6.57	6.50	6.57	6.78	6.85	6.82
Na2O	2.32	2.47	3.09	2.97	3.37	3.16	3.10	3.04	3.18	3.19
K2O	0.73	0.61	3.09	3.04	2.79	2.98	2.99	2.86	2.70	2.68
P2O5	0.230	0.233	1.020	0.988	0.977	0.941	0.913	0.848	0.882	0.866
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Unnormalized Trace Elements (ppm):										
Ni	56	51	2	2	1	2	2	3	2	3
Cr	105	104	3	4	2	4	3	2	1	1
Sc	36	37	27	27	26	27	27	28	27	28
V	280	282	158	166	164	179	190	222	228	224
Ba	473	274	4794	3789	3535	3370	3258	3027	3057	3037
Rb	17	13	54	53	45	49	49	45	46	46
Sr	241	239	324	299	285	276	277	277	283	277
Zr	139	143	534	507	496	480	473	446	453	446
Y	30	31	55	52	50	49	47	47	47	47
Nb	12.2	11.8	23.2	23.1	22.4	22.5	21.2	21.3	21.2	21.5
Ga	19	18	24	22	23	23	20	21	20	20
Cu	49	50	4	3	3	4	4	3	6	5
Zn	98	104	152	139	128	127	129	127	130	127
Pb	6	6	11	12	11	12	10	10	9	10
La	23	17	47	46	48	46	41	45	48	43
Ce	36	41	86	90	86	86	92	78	78	83
Th	2	3	8	7	7	7	5	5	7	6

Major elements are normalized on a volatile-free basis, with total Fe expressed as FeO.
"R" denotes a duplicate bead made from the same rock powder.

Analyses by Washington State University GeoAnalytical Laboratory

GEOCHEMICAL TEST RESULTS ON SAMPLES FROM DRILL HOLES AT THE BLACK ROCK ALTERNATE DAMSITE

AUGUST 2004

	LIN BRA-12	LIN BRA-13	LIN BRA-14	LIN BRA-15	LIN BRA-16	LIN BRA-13	LIN BRA13R
Date	9-Jul-04	9-Jul-04	9-Jul-04	9-Jul-04	9-Jul-04	9-Jul-04	9-Jul-04
Unnormalized Major Elements (Weight %):							
SiO2	50.46	49.02	51.71	50.91	50.96	49.02	48.91
TiO2	3.506	3.476	1.674	3.686	1.637	3.476	3.490
Al2O3	14.75	14.40	14.85	13.07	14.82	14.40	14.37
FeO*	11.43	12.09	10.43	13.82	10.86	12.09	12.30
MnO	0.201	0.542	0.175	0.206	0.162	0.542	0.545
MgO	3.16	3.27	6.66	3.87	6.20	3.27	3.26
CaO	9.91	10.19	10.85	8.77	11.00	10.19	10.14
Na2O	2.92	2.66	2.33	2.45	2.26	2.66	2.66
K2O	1.09	1.01	0.67	1.19	0.41	1.01	1.02
P2O5	0.980	0.818	0.235	0.579	0.233	0.818	0.818
Total	98.42	97.48	99.59	98.55	98.54	97.48	97.51
Normalized Major Elements (Weight %):							
SiO2	51.28	50.29	51.92	51.66	51.72	50.29	50.16
TiO2	3.563	3.566	1.681	3.741	1.661	3.566	3.579
Al2O3	14.99	14.77	14.92	13.27	15.04	14.77	14.73
FeO*	11.62	12.40	10.48	14.02	11.02	12.40	12.61
MnO	0.204	0.556	0.176	0.209	0.164	0.556	0.559
MgO	3.21	3.36	6.69	3.93	6.29	3.36	3.35
CaO	10.07	10.45	10.89	8.90	11.17	10.45	10.40
Na2O	2.97	2.73	2.34	2.49	2.29	2.73	2.73
K2O	1.11	1.04	0.68	1.20	0.42	1.04	1.04
P2O5	0.995	0.839	0.236	0.588	0.237	0.839	0.839
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Ni	37	29	45	12	44	29	30
Cr	103	103	107	15	106	103	103
Sc	41	41	36	32	36	41	41
V	398	403	287	422	284	403	400
Ba	657	525	261	804	247	525	524
Rb	29	30	15	32	10	30	30
Sr	331	324	235	247	250	324	324
Zr	208	208	140	271	142	208	208
Y	64	54	31	52	33	54	55
Nb	16.8	17.1	12.5	26.9	11.9	17.1	16.7
Ga	24	24	20	23	17	24	25
Cu	45	35	48	15	52	35	37
Zn	147	153	96	159	98	153	154
Pb	6	5	5	10	6	5	7
La	33	30	21	38	19	30	24
Ce	75	56	42	80	34	56	69
Th	4	4	2	6	2	4	3

Major elements are normalized on a volatile-free basis, with total Fe expressed as FeO.
"R" denotes a duplicate bead made from the same rock powder.

Analyses by Washington State University GeoAnalytical Laboratory